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EXAMINER	
ZERVIGON, RUDY	

ART UNIT	PAPER NUMBER
1792	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	09/788,365	NI ET AL.	
	Examiner	Art Unit	
	Rudy Zervigon	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 25 August 2009.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 25,28-36 and 38-45 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 25,28-36 and 38-45 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 25, 28-36, and 38-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koshimizu; Chishio (US 5,935,373 A) in view of Deacon; Thomas E. et al. (US 5792269 A) and Dornfest; Charles N. et al. (US 5680013 A). Koshimizu teaches a gas injector (156; Figure 1) for supplying process gas to a plasma processing chamber (102; Figure 1) wherein a semiconductor substrate ("W"; Figure 1) is subjected to plasma processing, the gas injector (156; Figure 1) sized to extend in an axial direction through a chamber wall (108; Figure 1) of the processing chamber (102; Figure 1) such that a planar axial distal end (bottom portion of 156; Figure 1) surface of the gas injector body (156; Figure 1) is exposed within the processing chamber (102; Figure 1), the gas injector body (156; Figure 1) including a bore (coaxial bore in 156; Figure 1) defined by a cylindrical sidewall (cylindrical sidewall of 156; Figure 1) and an endwall (planar endwall of 156; Figure 1) – claim 25

Koshimizu further teaches:

i. The gas injector (156; Figure 1) of Claim 25, wherein the gas injector (156; Figure 1) includes a planar axial end face (bottom portion of 156; Figure 1) which is dimensioned so as to be flush with an interior surface of a dielectric window (108; Figure 1) forming the chamber wall (108; Figure 1), as claimed by claim 29

ii. The gas injector (156; Figure 1) of Claim 25, wherein the gas injector body (156; Figure 1) includes a surface (top surface of 156; Figure 1) adapted to overlie an outer surface (top of 108) of the chamber (102; Figure 1), as claimed by claim 33

iii. The gas injector (156; Figure 1) of Claim 25, wherein the gas injector body (156; Figure 1) includes an annular flange (top surface of 156; Figure 1) having a surface (surface outside of chamber at 156/108 interface; Figure 1) adapted to overlie and contact an outer surface (top of 108) of the chamber wall (108; Figure 1), as claimed by claim 34

iv. A gas injector (156; Figure 1) for supplying process gas to a plasma processing chamber (102; Figure 1)wherein a semiconductor substrate ("W"; Figure 1) is subjected to plasma processing, the gas injector (156; Figure 1) comprising: gas injector body (156; Figure 1) sized to extend through a chamber wall (108; Figure 1) of the processing chamber (102; Figure 1)such that an axial distal end (bottom portion of 156; Figure 1) surface of the gas injector body (156; Figure 1) is exposed within the processing chamber (102; Figure 1)–claim 39

v. a cylindrical bore (coaxial bore in 156; Figure 1) adapted to supply gas to the gas outlet, the cylindrical bore (coaxial bore in 156; Figure 1) being defined by a sidewall and an endwall which extends radially inwardly from the sidewall – claim 39

vi. an annular flange (top surface of 156; Figure 1) adapted to overlie and contact an outer surface of the chamber wall (108; Figure 1) – claim 39

vii. A gas injector (156; Figure 1) for supplying process gas to a plasma processing chamber (102; Figure 1)wherein a semiconductor substrate ("W"; Figure 1) is subjected to plasma processing, the gas injector (156; Figure 1) comprising: a gas injector body (156; Figure

1) sized to extend axially through a chamber wall (108; Figure 1) of the processing chamber (102; Figure 1)such that a distal end (bottom portion of 156; Figure 1) surface of the gas injector body (156; Figure 1) is exposed within the processing chamber (102; Figure 1)– claim 41

viii. wherein the gas injector body (156; Figure 1) includes a uniform diameter central bore (central bore of 156; Figure 1), the central bore (central bore of 156; Figure 1) extending axially from an upper axial end face of the gas injector body (156; Figure 1), the central bore (central bore of 156; Figure 1) being defined by a cylindrical sidewall (cylindrical sidewall of 156; Figure 1) and a planar endwall (planar endwall of 156; Figure 1) extending between the cylindrical sidewall (cylindrical sidewall of 156; Figure 1) – claim 41

Koshimizu does not teach:

i. the gas injector (156; Figure 1) comprising gas injector body (156; Figure 1) of dielectric material – claim 25

ii. the gas injector body (156; Figure 1) including a plurality of gas passages in fluid communication with the bore (coaxial bore in 156; Figure 1), the gas passages adapted to supply process gas into the processing chamber (102; Figure 1), wherein the gas passages include gas inlets located in the endwall and gas outlets located in the planar distal end (bottom portion of 156; Figure 1) surface of the gas injector body (156; Figure 1) with the total area of the gas outlets less that the cross-sectional area of the bore (coaxial bore in 156; Figure 1) and the gas outlets are sized to inject the process gas at a subsonic, sonic or supersonic velocity; wherein the gas inlets are closer to a central axis of the bore than

the gas outlets and the gas inlets of the angled gas passages are located equal distances from the central axis of the bore (coaxial bore in 156; Figure 1) - claim 25

iii. The gas injector (156; Figure 1) of Claim 25, the gas passages include a center gas passage extending in the axial direction and a plurality of angled gas passages extending at an acute angle to the axial direction, as claimed by claim 28

iv. The gas injector (156; Figure 1) of Claim 29, wherein the gas injector (156; Figure 1) includes at least one seal adapted to contact the dielectric window (108; Figure 1) when the gas injector (156; Figure 1) is mounted in the dielectric window (108; Figure 1), as claimed by claim 30

v. The gas injector (156; Figure 1) of Claim 25, wherein the gas passages include a plurality of angled gas passages which inject process gas at an acute angle relative to a plane parallel to the distal end (bottom portion of 156; Figure 1) surface, as claimed by claim 31

vi. The gas injector (156; Figure 1) of Claim 25, wherein the gas injector (156; Figure 1) is adapted to be removably mounted in an opening in the chamber wall (108; Figure 1) and includes at least one O-ring providing a vacuum seal between the gas injector (156; Figure 1) and the chamber wall (108; Figure 1),as claimed by claim 32

vii. The gas injector (156; Figure 1) of Claim 25, wherein the gas injector body (156; Figure 1) includes at least one O-ring seal on an outer surface of the gas injector body (156; Figure 1), as claimed by claim 35

viii. The gas injector (156; Figure 1) of Claim 25, wherein the gas injector body (156; Figure 1) includes a first O-ring seal on an outer surface of the gas injector body (156; Figure 1)

and a second O-ring seal in a surface of a flange extending from the outer surface of the gas injector body (156; Figure 1), as claimed by claim 36

ix. The gas injector (156; Figure 1) of Claim 25, wherein all of the gas passages supply process gas through the distal end (bottom portion of 156; Figure 1) surfaces of the gas injector body (156; Figure 1), as claimed by claim 38

x. the gas injector body (156; Figure 1) including a plurality of gas passages adapted to supply process gas into the processing chamber (102; Figure 1) and a cylindrical bore (coaxial bore in 156; Figure 1) adapted to supply gas to the gas passages, the cylindrical bore (coaxial bore in 156; Figure 1) being defined by a sidewall and an endwall which extends radially inwardly from the sidewall, the gas passages including a center gas passage extending in the axial direction and a plurality of angled gas passages extending at an acute angle to the axial direction, wherein the gas inlets of the angled passages are closer to a central axis of the bore than the gas outlets of the angled gas passages <u>and the gas inlets of the angled gas passages are located equal distances from the central axis of the bore (coaxial bore in 156; Figure 1)</u>; an annular flange (top surface of 156; Figure 1) adapted to overlie and contact an outer surface of the chamber wall (108; Figure 1) ; and a first O-ring in a surface of the flange for sealing against the outer surface of the chamber wall (108; Figure 1) – claim 39

xi. the gas passages including gas inlets located in the endwall and gas outlets located in the distal end surface – claim 39

xii. The gas injector (156; Figure 1) of Claim 39, comprising a second O-ring seal on an outer surface of the gas injector body (156; Figure 1), as claimed by claim 40

xiii. the gas injector body (156; Figure 1) including a plurality of gas passages adapted to supply process gas into the processing chamber (102; Figure 1), wherein the gas passages are located in the axial distal end (bottom portion of 156; Figure 1) surface of the gas injector body (156; Figure 1) and the gas passages being sized to inject the process gas at a subsonic, sonic or supersonic velocity – claim 41

xiv. wherein the gas injector body (156; Figure 1) is adpated to supply gas to the gas passages , and the gas passages include gas inlets located in the planar endwall (planar endwall of 156; Figure 1) and gas outlets located in the distal end surface of the gas injector body (156; Figure 1), the gas passages being sized to inject the process gas at a subatomic, sonic or supersonic velocity wherein the gas inlets are closer to a central axis of the bore than the gas outlets <u>and the gas inlets of the angled gas passages are located equal distances from the central axis of the bore (coaxial bore in 156; Figure 1)</u> – claim 41

xv. A gas injector (156; Figure 1) for supplying process gas to a plasma processing chamber (102; Figure 1)wherein a semiconductor substrate ("W"; Figure 1) is subjected to plasma processing, the gas injector (156; Figure 1) comprising a gas injector body (156; Figure 1) made of a dielectric material selected from the group consisting of quartz, alumina and silicon nitride and sized to axially extend through a chamber wall (108; Figure 1) of the processing chamber (102; Figure 1)such that a planar distal end (bottom portion of 156; Figure 1) surface of the gas injector body (156; Figure 1) is exposed within the processing chamber (102; Figure 1), the gas injector body (156; Figure 1) including a bore defined by a cylindrical sidewall (cylindrical sidewall of 156; Figure 1) and an endwall and a plurality of gas passages adapted to supply process gas into the processing

chamber (102; Figure 1), wherein the gas passages include gas inlets located in the endwall and gas outlets located in the planar distal end (bottom portion of 156; Figure 1) surface of the gas injector body (156; Figure 1) and the gas passages being sized to inject the process gas at a subsonic, sonic or supersonic velocity; wherein the gas inlets are closer to a central axis of the bore than the gas outlets <u>and the gas inlets of the angled gas passages are located equal distances from the central axis of the bore (coaxial bore in 156; Figure 1)</u>, as claimed by claim 42

xvi. The gas injector (156; Figure 1) of Claim 28, wherein the gas injector body (156; Figure 1) includes 8 of the angled gas passages, as claimed by claim 43

xvii. The gas injector (156; Figure 1) of Claim 28, wherein the acute angle is 10 to 70°, as claimed by claim 44

xviii. The gas injector (156; Figure 1) of Claim 28, wherein the angled gas passages direct the process gas such that the process gas does not flow directly towards a substrate ("W"; Figure 1) being processed, as claimed by claim 45

Deacon teaches a gas distribution plate (40; Figure 4) for semiconductor manufacturing apparatus (Figure 2) including plural, angled, passages (42; Figure 5,6; column 4; lines 10-35). Specifically Deacon teaches a gas injector body (40; Figure 4) including a plurality of gas passages (42; Figure 5,6; column 4; lines 10-35), where the gas passages (42; Figure 5,6; column 4; lines 10-35) are adapted to supply process gas into a processing chamber (Figure 2), and are located in the planar axial distal end surface of the gas injector body (Figure 4). Further, Deacon establishes that the angle the passages (42; Figure 5,6; column 4; lines 10-35) make with the normal is a result-effective-variable (column 4; lines 10-20). Only result-effective variables can

be optimized (In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). See also In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP2144.05. Deacon further teaches <u>the gas inlets (top of 41,42; Figures 5,6) of the angled gas passages (41,42; Figures 5,6) are located equal distances ("uniformly distributed"; column 4; lines 35-45) from the central axis of the injector body (40; Figure 4).</u>

Dornfest teaches ceramic protection for plasma electrodes (Figures 14,15; column 2; lines 38-53).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add Deacon's plural, angled, passages (42; Figure 5,6; column 4; lines 10-35) to Koshimizu's gas injector as taught by Deacon, including ceramic protection as taught by Dornfest and sealed for hemiticity.

Motivation to add Deacon's plural, angled, passages (42; Figure 5,6; column 4; lines 10-35) to Koshimizu's gas injector as taught by Deacon, including ceramic protection as taught by Dornfest and sealed for hemiticity, is for improved sidewall and step coverage as taught by Deacon (column 4; lines 20-35) and for protecting the plasma electrode surfaces from chemical and physical attack by the process plasma as taught by Dornfest (column 2; lines 38-52).

Response to Arguments

3. Applicant's arguments filed August 25, 2009 have been fully considered but they are not persuasive.

4. Applicant states:

"

Koshimizu discloses a gas processing supply port 156 for plasma etching apparatus 100 (column 5, lines 42-43; FIG. 1), but provides no disclosure of gas passages in an endwall in gas processing supply port 156 (FIG. 1). The Official Action cites Deacon for angled gas passages but neither Deacon nor Koshimizu provides any suggestion of a gas injector body wherein "the gas inlets are closer to a central axis of the bore than the gas outlets and the gas inlets of the angled gas passages are located equal distances from the central axis of the bore," as recited in Claims 25, 39, 41 and 42.

"

And..

"

Deacon provides various gas hole arrangements wherein gas inlets are located at various distances from a center of the faceplate. Clearly Deacon provides no suggestion of a gas injector body having "a center gas passage extending in the axial direction and a plurality of angled gas outlets extending at an acute angle to the axial direction,", wherein the gas inlets of the angled gas passages are closer to a central axis of the bore than the gas outlets of the angled gas passages and the gas inlets of the angled gas passages are located equal distances from the central axis of the bore as recited in Claim 39

"

In response, Applicant's argumnets are based on the amended features of the pending claims. In response, the Examiner believes that Deacon Deacon further teaches <u>the gas inlets (top of 41,42;</u>

<u>Figures 5,6) of the angled gas passages (41,42; Figures 5,6) are located equal distances ("uniformly distributed"; column 4; lines 35-45) from the central axis of the injector body (40; Figure 4).</u> Likewise, the Examiner's proposed combination of references would suggest to persons of ordinary skill in the art that such an *addition* of holes to Koshimizu's gas injector (156; Figure 1), as claimed, would be obvious. It is well established throughout Deacon that the hole arrangement and angles thereof are *result-effective-variables*. Only result-effective variables can be optimized (In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). See also In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP2144.05. Deacon's well grounded rational for his hole distribution and angled positions thereof is for improved sidewall and step coverage as taught by Deacon (column 4; lines 20-35). Such a determination is tested throughout the Deacon reference with favorable results for such geometries.

Applicant states:

"

Dornfest is cited only for features of ceramic protection and thus fails to cure the deficiencies of Koshimizu and Deacon

"

5. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272-1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official fax phone number for the 1792 art unit is (571) 273-8300. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (571) 272-1700. If the examiner can not be reached please contact the examiner’s supervisor, Parviz Hassanzadeh, at (571) 272-1435.

/Rudy Zervigon/

Primary Examiner, Art Unit 1792